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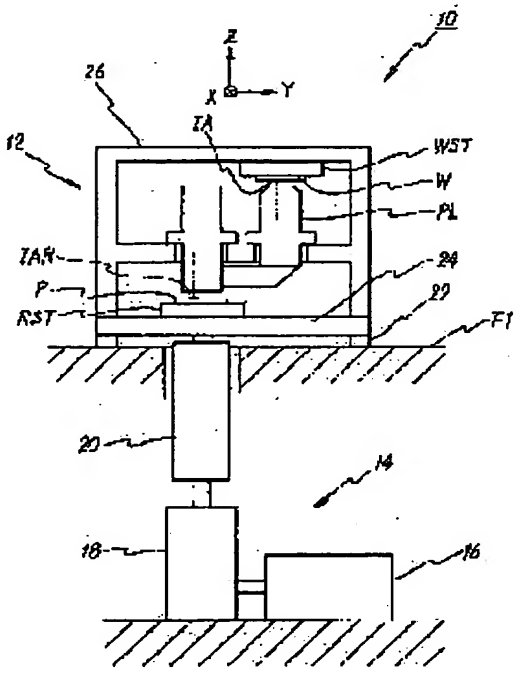
(54) ALIGNER AND ITS USING METHOD, EXPOSURE METHOD, AND MANUFACTURING METHOD OF MASK

(57)Abstract:

PROBLEM TO BE SOLVED: To realize an aligner which is miniaturized and made light-weight and reduction in footprint for an aligner.

SOLUTION: An aligner includes the lighting system for lighting a mask (R) from below, a mask stage (RST) for holding the mask (R) below a projecting optical system (PL), and a substrate stage (WST) for holding the substrate (W) above the projection optical system (PL) and two-dimensionally moving the substrate (W). Since the mark (R) is irradiated from below, an illuminating system 14 can be provided independently of the main body of exposure apparatus that includes the mask stage (RST), the projection optical system (PL), and the substrate stage (WST). In this way, the illuminating system is not included in the exposure main body as before, so that the main body can be made small in size and light weight, and the footprint can be reduced.



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CLAIMS

[Claim(s)]
[Claim 1] The illumination system which is the aligner which imprints to a substrate the pattern formed in the mask through projection optics, and illuminates said mask from a lower part, and the mask stage which holds the; aforementioned mask horizontally in the lower part of said projection optics; an aligner equipped with the substrate stage which holds said substrate horizontally and carries out two-dimensional migration in the upper part of said projection optics.
[Claim 2] For the body of an aligner including said projection optics, said mask stage, said substrate stage, etc., said illumination system is an aligner according to claim 1 characterized by dissociating and being arranged in the indoor under floor in which the body of an aligner concerned is installed.
[Claim 3] Operation of the aligner characterized by imprinting the pattern of the 1st mask which is the operation of an aligner according to claim 1, and was held in said mask stage to the substrate for masks held through said projection optics on said substrate stage, and manufacturing the 2nd mask.
[Claim 4] Said substrate stage is the operation of the aligner according to claim 3 characterized by placing a pattern formation side upside down and supporting said substrate for masks by at least three points.
[Claim 5] The exposure approach characterized by placing the pattern formation side upside down, holding said 2nd mask manufactured by claim 3 or the approach of 4, and imprinting the pattern of said 2nd mask on a sensitization substrate.
[Claim 6] The manufacture approach of the mask characterized by carrying out patterning of said sensitization material of the substrate for masks with which it is the manufacture approach of the mask used for an aligner according to claim 1, and the sensitization material spreading side was held in the upward condition at the substrate attachment component.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of a mask at an aligner and its operation, the exposure approach, and a list, and relates to the aligner used at a lithography process on the occasion of manufacture of a semiconductor device, a liquid crystal display component, etc. in more detail and its operation, the exposure approach, and the manufacture approach of the mask used for a list with said aligner.
[0002]
[Description of the Prior Art] The aligner which imprints patterns formed in the mask (or reticle) at the photolithography process for manufacture, such as a semiconductor device, on substrates, such as a wafer, through projection optics is used. As this aligner, the aligner of scan exposure molds, such as a stepper which is the quiescence aligner of a migration mold serially, and slit scan or step -, - scan, is used.
[0003] With this conventional kind of equipment, g line (wavelength: 436nm), i line (wavelength: 365nm), etc. are used as an exposure light, and, recently, KrF excimer laser light (wavelength: 248nm) etc. is used. When using the exposure light of these wavelength bands, since the projection optics itself was not enlarged so much while sufficient reduction percentage was obtained even if it used dioptric system as projection optics, dioptric system was used.
[0004] An example of the projection aligner which makes the conventional KrF excimer laser the light source is roughly shown in drawing 4 . This projection aligner A vibration absorbing pad 100 is minded. Wafer W is held on the top face of the projection optics 103 which consists of the dioptric system held at the supporter material 101 held horizontally, the body frame 102 fixed on this supporter material 101, and the body frame 102, and said supporter material 101. It is fixed on the wafer stage 104 which carries out two-dimensional migration, the reticle stage 106 which is laid in the top face of said body frame 102, and holds a reticle 105, and said supporter material 101. To the upper part of a reticle stage 106 It has the excimer laser 109 grade optically connected to the illumination-light study system 107 and this illumination-light study system 107 which are prolonged through the beam matching unit 108.
[0005]
[Problem(s) to be Solved by the Invention] The densification of a semiconductor integrated circuit progresses every year, and it is said from 64 megabytes from 16 megabytes of DRAM to 64 megabytes of DRAM that it will become a 1-G byte time to 256 megabytes still more in the future. If it goes into a 256-megabyte time, line breadth of a circuit pattern will be increasingly made detailed, and will become thin to 0.2 microns or less.
[0006] For this reason, it will be necessary to also shorten wavelength of exposure light according to pattern line breadth, and even if it is the conventional KrF excimer laser aligner, dealing with this becomes difficult. Then, as a next-generation machine, development of the aligner using ArF excimer laser light (wavelength: 193nm) or the light of wavelength shorter than this as an exposure light is expected.
[0007] However, since many optical elements (lens) are needed when using ArF excimer laser light with a wavelength of 200nm or less as an exposure light and dioptric system tends to constitute the highly precise projection optics which has sufficient reduction percentage, the projection optics will

become very big and the use will become difficult practically. So, in such an aligner, there is a motion by the optical system of the reflective refraction mold which has the two lens-barrel sections which are indicated by JP,7-111512,B, for example being adopted as projection optics.
[0008] However, if it is going to constitute the projection aligner equipped with this reflective refraction type of projection optics like the conventional projection aligner as shown in drawing 4 , while an aligner (chamber which contains the body of an aligner and this) will be enlarged, following un-arranging [various] arise.
[0009] That is, when using the projection optics of a reflective refraction mold, the body frame (body column) holding this and the supporter material in which this body frame is further carried with an illumination-light study system are enlarged, and the body of an aligner and a chamber are enlarged as a result. For this reason, while the load concerning the floor of the clean room in which equipment is installed becomes large, the increment in the footprint of equipment and the rise of clean room cost are caused.
[0010] Moreover, in order that enlargement of equipment and weight-ization might reduce the own natural frequency of equipment, a possibility that a bad influence might arise was in the controllability ability of moving parts, such as a wafer stage. That is, when the own resonant frequency of equipment fell, for example, it became close to an air-conditioning fan's etc. control frequency, fear of equipment resonating carelessly was during operation.
[0011] Since the synchronous precision of a reticle stage and a wafer stage is very important in the case of scanning aligners, such as a scanning stepper, but the equipment vibration at the time of a synchronized drive becomes the factor which worsens synchronous precision by enlargement of a body frame etc. and a high throughput is required especially in addition to this, there is also un-arranging [that the burden of the equipment developer who requires for adjustment of a reticle stage, a wafer stage etc. increases].
[0012] Furthermore, it corresponds to the formation of the extensive field of these days, and high N.A.-ization of projection optics, and there is an inclination for the size of an illumination-light study system to also become still larger.
[0013] This invention was made under this situation and the purpose is in offering the aligner which can realize formation of small lightweight of the body of an aligner, and reduction of a footprint, the suitable operation of the aligner, etc.
[0014]
[Means for Solving the Problem] The illumination system (14) which the aligner concerning this invention is an aligner which imprints the pattern formed in the mask (R) to a substrate (W) through projection optics (PL), and illuminates said mask from a lower part, and the mask stage which holds the; aforementioned mask horizontally in the lower part of said projection optics (RST); it has the substrate stage (WST) which holds said substrate horizontally and carries out two-dimensional migration in the upper part of said projection optics.
[0015] According to this, since an illumination system illuminates a mask from a lower part, with a mask stage, projection optics, and a substrate stage, it becomes possible to dissociate and arrange. That is, small and lightweight-izing of the part and the body of an aligner with which the body of an aligner is constituted by the frame holding a mask stage, projection optics, a substrate stage, and these etc., and an illumination-light study system is not contained in the body of an aligner like before, and reduction of a footprint are possible.
[0016] In this case, as for the body of an aligner (12) including said projection optics (PL), said mask stage (RST), said substrate stage (WST), etc., it is [said illumination system (14)] desirable to dissociate and to arrange under the indoor (inside of a clean room) floor (F1) in which the body of an aligner concerned is installed. In this case, in addition to the ability to decrease the footprint of equipment, the optical path of the illumination light can be shortened compared with the case where an illumination system is arranged to the next room etc., as a result simplification of the configuration of an illumination-light study system and reduction of optic mark are possible.
[0017] Imprinting the pattern of the 1st mask held in said mask stage as operation of the aligner concerning this invention to the substrate for masks held through said projection optics on said substrate stage, and manufacturing the 2nd mask is mentioned. Namely, in the exposure process for the 2nd mask manufacture, if it does in this way, where a pattern side is held downward on a

substrate stage, as for the substrate for masks, the pattern of the 1st mask (parent mask) will be imprinted. Therefore, by using this 2nd mask as a mask (reticle) of the same usual aligner (for a mask stage, a substrate stage is a lower aligner in a top) as the conventional example mentioned above The condition of the bending which exposure produces with the self-weight at the time of a line crack and manufacture of the 2nd mask where a pattern formation side is held downward for the 2nd mask like the time of the manufacture in a mask stage, The bending condition at the time of exposing by using the 2nd mask as a mask can be brought close, and little highly precise exposure of the effect of a mask of bending is attained.

[0018] As for said substrate stage, in the case of manufacture of the 2nd above-mentioned mask in this semantics, it is desirable like maintenance of the mask of the usual aligner to place a pattern formation side upside down and to support said substrate for masks by at least three points. thus, the condition of the bending which will be produced with the self-weight at the time of manufacture of the 2nd mask if it carries out and its bending condition at the time of exposing by using the 2nd mask as a mask -- about -- it becomes possible to make it do one.

[0019] The exposure approach of this invention places the pattern formation side upside down, holds the 2nd mask manufactured by the above-mentioned operation, and is characterized by imprinting the pattern of said 2nd mask on a sensitization substrate.

[0020] Moreover, the manufacture approach of the mask used for the aligner concerning this invention is characterized by carrying out patterning of said sensitization material of the substrate for masks with which the sensitization material spreading side was held in the upward condition at the substrate attachment component. Since a sensitization material spreading side is held in the upward condition at a substrate attachment component at the time of that manufacture, when the mask manufactured by this manufacture approach lays this mask on the mask stage of the aligner concerning this invention, a pattern side will be held upward by this mask like the time of manufacture in a mask stage. Therefore, the condition of the bending produced with the self-weight at the time of manufacture of a mask and its bending condition at the time of exposing by using the mask as a mask can be brought close, and little highly precise exposure of the effect of a mask of bending is attained.

[0021]

[Embodiment of the Invention] Hereafter, 1 operation gestalt of this invention is explained based on drawing 1 - drawing 2 . The configuration of the aligner 10 of 1 operation gestalt is roughly shown in drawing 1 . This aligner 10 is step - and the contraction projection aligner of - scanning method, i.e., the so-called scanning stepper.

[0022] This projection aligner 10 consists of two parts of the body 12 of an aligner installed on the floor F1 of a clean room, and the illumination system 14 arranged in the service room located under the floor F1 of said clean room.

[0023] The excimer laser 16 by which said illumination system 14 was installed in above the floor level [of a service room] (for example, F2 [with a KrF excimer laser of with a wavelength of 248nm, an ArF excimer laser of with a wavelength of 193nm, and a wavelength of 157nm] excimer laser etc.), The beam matching unit 18 containing the cylindrical lens which operates orthopedically the laser beam injected from this excimer laser 16, a beam expander, etc., A relay lens, a condensing lens, a blind, etc. are included. The laser beam after plastic surgery by the beam matching unit 18 Illuminance equalization, It has the illumination-light study system 20 which illuminates the predetermined lighting field IAR on the reticle R which performs speckle reduction, a limit of a beam cross-section configuration, etc., and is later mentioned by this laser beam (illumination light for exposure) from a lower part.

[0024] The surface plate 24 with which said body 12 of an aligner was held horizontally on the floor F1 of a clean room by two or more vibration absorbing pads 22, The projection optics PL which consists of the cata-dioptric system of the height direction (Z direction) of the body frame 26 fixed on this surface plate 24, and this body frame 26 held mostly at the mid gear The reticle stage RST as a mask stage which it is laid in the top face of said surface plate 24, and is driven with a non-illustrated linear motor etc. to a predetermined scanning direction (here, it considers as the direction of Y), It has the wafer stage WST as a substrate stage which carries out XY two-dimensional migration along the inferior surface of tongue of the top-plate section of said body frame 26.

[0025] Although the optical system same as said projection optics PL as what is indicated by JP,7-111512,B etc. is used, since it is well-known, it omits about the detailed explanation. Moreover, reduction percentage sufficient in this projection optics PL shall be obtained, and that projection scale factor shall be 1/alpha (alpha is 4, 5, or 6) here.
[0026] On said reticle stage RST, the pattern side is turned up, through the non-illustrated vacuum chuck, vacuum adsorption is carried out and the reticle R as a mask is held.
[0027] An example of the configuration (a mechanical component is included) of said wafer stage WST is shown in drawing 2 . As shown in this drawing 2 , the wafer stage WST is equipped with the Y stage 34 where it moves in the direction of Y along with Y linear guides 32A and 32B of a pair, and the X stage 38 where it moves in the direction of X along with X linear guides 36A and 36B of the pair prepared in the base of this Y stage 34. Corresponding to said Y linear guides 32A and 32B, the needles 33A and 33B of Y linear motor of a pair are formed in the top face of the Y stage 34 in one. Moreover, corresponding to said X linear guides 36A and 36B, the needles 37A and 37B of X linear motor of a pair are formed in the top face of the X stage 38. Moreover, although illustration was omitted in this case, the wafer holder which carries out adsorption maintenance of the wafer W as a substrate through non-illustrated Z drive is formed in the base side of the X stage 38.
[0028] Here, you may fix to the inferior-surface-of-tongue side of the top-plate section of the body frame 26 of drawing 1 , or Y linear guides 32A and 32B may be laid under the top-plate circles. Anyway, XY two-dimensional migration of Wafer W by which adsorption maintenance was carried out, and adjustment of Z location are possible to the wafer holder which is not illustrated by such configuration.
[0029] In addition, you may make it the configuration and the drive approach of the wafer stage WST be not only this but a degree. The permanent magnet (or electromagnet) which is not illustrated in the top-plate section of the body frame 26 is arranged in the XY two-dimensional direction at intervals of predetermined, the self-weight of the wafer stage WST is supported with the magnetic attraction of these magnets, two or more air pads (illustration abbreviation) are fixed to the base (top face in drawing 1) of the wafer stage WST, and surfacing support of the wafer stage WST is caudad carried out through several micrometers path clearance from a top-plate section inferior surface of tongue according to the surfacing force of this air pad. And you may make it drive the wafer stage WST in this condition that surfacing support was carried out, in the XY two-dimensional direction with driving gears, such as a non-illustrated flat-surface mold motor.
[0030] Where alignment of Wafer W and Reticle R is performed according to the aligner 10 constituted as mentioned above, if a laser beam (exposure light) is injected from the light source 16, this laser beam will pass along the beam matching unit 18 and the illumination-light study system 20, and that cross-section configuration will be restricted by the blind in the illumination-light study system 20 in this case. And this exposure light illuminates the lighting field IAR of the shape of a slit on the reticle R by which the circuit pattern was drawn through the relay lens, the condensing lens, etc. with a uniform illuminance. next, incidence of the exposure light which penetrated Reticle R is carried out to projection optics PL, thereby, the circuit pattern of Reticle R is reduced 1/alpha twice, and it is projected on the lighting field IAR and the exposure field IA on the wafer [****] W. In this case, in accordance with Y shaft orientations, the synchronous scan of Reticle R and the wafer W of each other is carried out with the velocity ratio according to a projection scale factor at the reverse sense, it does in this way, and the whole pattern of Reticle R is imprinted by the one-shot field on Wafer W. It is carried out while such scan exposure carries out step migration of the wafer W one by one, and the pattern of Reticle R is imprinted by all the shot fields on Wafer W.
[0031] While the height of the component of the aligner 10 exposed on the body 14 F1 of an aligner, i.e., the floor of a clean room, becomes low as compared with the conventional example of drawing 4 so that clearly since the illumination system 14 is separated from the body 12 of an aligner according to the aligner 10 of this operation gestalt explained above, the footprint of the part equipment which does not carry an illumination-light study system on a surface plate 24 can be decreased. Moreover, equipment weight is also light. Thus, if unit elevation is low and equipment weight becomes light, the load concerning the floor F1 of a clean room also became small, and has led to the cost cut of a clean room.
[0032] Moreover, since the natural frequency of the body 12 of an aligner becomes high, it has been

hard coming to generate a bad influence in the controllability ability of moving parts, such as a reticle stage RST and the wafer stage WST.
[0033] Moreover, since the body 12 of an aligner lightweight[small and]-izes and the height dimension is low, the vibration at the time of a stage drive was also reduced, the synchronization error of a reticle stage RST and the wafer stage WST was also reduced, and the burden of development, such as the reticle stage RST of a high throughput and the wafer stage WST, has also been mitigated.
[0034] Furthermore, even if it corresponds to the formation of the extensive field of these days, and high N.A.-ization and the size of an illumination-light study system becomes still larger, the clean room tooth space in which the bottom, the chamber which contained the body 12 of an aligner since it had specifically arranged under a floor F1, as a result this chamber of a surface plate 24 are installed in an illumination-light study system is not made to increase.
[0035] According to this operation gestalt, moreover, the illumination system 14 containing an illumination-light study system Since it is arranged in the indoor (inside of a clean room) under floor in which it separates into in the body 12 of an aligner, and the body 12 of an aligner concerned is installed Since the optical path of the illumination light can be shortened compared with the case where an illumination system is arranged to the next room etc. and there is moreover no clinch part of exposure light into an illumination-light study system, the configuration of the part illumination-light study system can be simplified, and reduction of the components mark of an optic is possible.
[0036] The operation of <<aligner, and exposure approach>> A reticle stage as shown in drawing 4 may use the aligner 10 of the above-mentioned operation gestalt in a top as a manufacturing installation of the working reticle (the 2nd mask) by which a wafer stage is used for a lower stepper or a lower scanning stepper (it is hereafter called "the usual aligner" suitably). Hereafter, the case where an aligner 10 is used as a reticle manufacturing installation is explained.
[0037] First, the mother reticle as the 1st mask (parent mask) first used for manufacture of a working reticle is carried out like ** of a degree - **, and is manufactured.
** the pattern (it is hereafter called a "original edition pattern") which should be formed on a working reticle -- alpha twice (alpha is the inverse number of the projection scale factor of an aligner 10 like the above) -- create the parent pattern carried out on the image data of a computer, divide the parent pattern in all directions as an example, respectively, and create the parent pattern P1 of an alphaxalpha individual, and P2, --, PN (N=alpha2) on image data. Then, the drawing data for electron beam exposure systems (or laser beam drawing equipment etc.) are generated from those parent patterns Pi (i= 1 - N), respectively.
** the substrate top of the light transmission nature which consists of quartz glass etc. -- chromium (Cr) and silicification -- draw the actual size image of the parent pattern Pi (i= 1 - N) on the electron beam resist using electron ray beam drawing equipment, respectively after preparing N substrates for mother reticles which form the thin film of mask ingredients, such as molybdenum (MoSi2), and change and applying an electron beam resist on the mask ingredient film of each substrate for mother reticles.
** And the parent pattern Pi (i= 1 - N) is formed by performing resist development, etching, resist exfoliation, etc. to each substrate for mother reticles with which each parent pattern was drawn, respectively. Under the present circumstances, each mother reticle Ri Upwards, it is the parent pattern Pi. It receives and the alignment mark is also formed by position relation. Thereby, it is the mother reticle Ri of N sheets. It completes.
[0038] next, the substrate top of the light transmission nature which consists of quartz glass etc. on the wafer stage WST of an aligner 10 -- chromium (Cr) and silicification -- the thin film of mask ingredients, such as molybdenum (MoSi2), is formed, and the substrate for working reticles (substrate for masks) with which the photoresist was applied on it is laid. In this case, as a wafer holder for the alignment mark being beforehand formed in a position, and holding the substrate for working reticles, the thing of structure which holds [adsorption-] or mechanical holds two or more [around that substrate for working reticles] (at least three points) from a lower part shall be used for the substrate for working reticles like reticle stages, such as the usual stepper.
[0039] And, carrying out sequential loading of each mother reticle Ri (i= 1 - N) on a reticle stage RST Based on the measurement value of the alignment mark location on the above-mentioned

substrate for working reticles, and a wafer interferometer, step migration of the wafer stage WST is carried out one by one. The so-called SUTITCHINGU exposure (tying doubling exposure) is performed by carrying out the contraction imprint (projection scale-factor 1/alpha) of the pattern of each mother reticle by position relation one by one on the substrate for working reticles (substrate for masks). Thereby, the imprint image (latent image) of the original edition pattern with which N shots of contraction images of 1/alpha of each mother reticle were connected in predetermined sequence and which was mentioned above is formed in the photoresist of the substrate for working reticles.
[0040] And a working reticle is completed by performing resist development, etching, resist exfoliation, etc. to this substrate for working reticles.
[0041] Moreover, the exposure approach concerning this invention is performed as follows, for example. That is, the pattern formation side (field in which the above-mentioned original edition pattern was formed) is placed upside down, the working reticle as the 2nd mask manufactured as mentioned above is held to the reticle stage of the usual aligner, and the sequential imprint of the original edition pattern of the working reticle is carried out on the wafer as a sensitization substrate for 1/(beta is 4, 5, or 6 grades) of predetermined projection scale factors beta.
[0042] As mentioned above, when an aligner 10 is used as a manufacturing installation of a working reticle (the 2nd mask), where a pattern side is held downward on the wafer stage WST, as for the substrate for masks, the pattern of a mother reticle is imprinted in the exposure process for manufacture of a working reticle. By using this working reticle as a reticle of the usual aligner as mentioned above, therefore, a working reticle Since exposure is performed where the pattern formation side is held downward on a reticle stage like the time of manufacture The condition of the bending produced with the self-weight at the time of manufacture of a working reticle and its bending condition at the time of exposing by making a working reticle into a reticle approximate, and little highly precise exposure of the effect of bending of a reticle is attained. Especially, in the case of manufacture of a working reticle, like maintenance of the reticle of the usual aligner, since the wafer stage WST places a pattern formation side upside down and supported the substrate for working reticles by at least three points, it becomes possible to make mostly in agreement the condition of the bending produced with the self-weight at the time of manufacture of a working reticle and its bending condition at the time of exposing by making it into a reticle.
[0043] moreover, the original edition pattern with which the pattern of each mother reticle in the case of using an aligner 10 as a manufacturing installation of a working reticle should be formed in a working reticle -- alpha twice, since it is some parent patterns carried out the manufacture approach of the conventional working reticle (photo mask) which an electron beam exposure system etc. is used for the drawing amount of data of the pattern of each mother reticle on a substrate, and draws an original edition pattern -- comparing -- drawing data -- 1/alpha 2 Decreasing to extent, minimum line width becomes alpha twice. Therefore, the pattern of each mother reticle can be drawn with high precision by few drifts in a short time, for example using the conventional electron beam exposure system or laser beam drawing equipment with a precision lower than this, respectively. Moreover, the drawing error by drawing equipment has many advantages of the precision of an original edition pattern improving more in order to decrease to 1/alpha.
[0044] Moreover, when the case where two or more kinds of working reticles for devices of limited production with a wide variety, such as so-called ASIC, so-called system LSI, etc., are manufactured is considered, all the patterns to imprint do not differ completely for every form, and each device has circuit blocks, such as the common CPU section and the RAM section, also between different forms in many cases. In consideration of this point, the division approach which paid its attention to every [corresponding to not the above simple division but a predetermined circuit block] unit pattern and those combination patterns as the division approach of the parent pattern of the original edition pattern in the case of using an aligner 10 as a manufacturing installation of a working reticle may be adopted. If it does in this way, it is also possible to manufacture many kinds of working reticles for a short time using the mother reticle of number of sheets small as a whole.
[0045] Manufacture approach>> of <<mask Next, an example of the manufacture approach of Reticle R used for an aligner 10 is explained.
[0046] first, the substrate top of the light transmission nature which consists of quartz glass etc. -- chromium and silicification -- the substrate for masks in which the thin film of mask ingredients,

such as molybdenum, was formed is prepared, and an electron beam resist is applied on the mask ingredient film of this substrate for masks. Next, a resist spreading side (sensitization material spreading side) carries out adsorption maintenance of the substrate for masks after this resist spreading in the upward condition on the substrate holder (substrate attachment component) of an electron beam exposure system. And the actual size image of an original edition pattern is drawn on an electron beam resist using the data for original edition pattern drawing created beforehand (patterning).

[0047] And an original edition pattern is formed by performing resist development, etching, resist exfoliation, etc. to the substrate for masks with which the original edition pattern was drawn. Under the present circumstances, on Reticle R, the alignment mark is also formed by position relation to the original edition pattern. Thereby, Reticle R is completed.

[0048] Since a resist side (pattern formation side), i.e., a mask ingredient forming face, is held in the upward condition at a substrate attachment component and patterning of a pattern is performed at the time of that manufacture, when the reticle R manufactured by this manufacture approach lays this mask on the reticle stage RST of an aligner 10, as for this reticle R, a pattern side is held upward like the time of manufacture. Therefore, little highly precise exposure of the effect of bending of Reticle R is attained like the above-mentioned.

[0049] Of course, Reticle R may be manufactured by SUTITCHINGU exposure like the above-mentioned, using the usual aligner as a manufacturing installation of Reticle R. Also in this case, since a pattern imprint is performed in the condition of facing up [substrate / for masks / forming face / (pattern side) / the / mask ingredient], little highly precise exposure of the effect of bending of Reticle R is attained as a result.

[0050] In addition, although the above-mentioned operation gestalt explained the case where this invention was applied to the aligner (scanning stepper) of step - equipped with the cata-dioptric system which has the two lens-barrel sections as projection optics, and - scanning method, of course, the applicability of this invention is not limited to this. For example, as shown in drawing 3 , it can apply suitable also for the aligner equipped with dioptric system as projection optics PL, and effectiveness equivalent to the above-mentioned operation gestalt can be acquired.

[0051] Moreover, although the above-mentioned operation gestalt explained the scanning stepper which uses excimer laser light as an exposure light, of course, the scanning stepper for which not only this but this invention uses a G string and i line as an exposure light is applicable suitable for the wafer stepper of a step-and-repeat method, other liquid crystal aligners, etc.

[0052]

[Effect of the Invention] As explained above, according to the aligner concerning this invention, formation of small lightweight of the body of an aligner and reduction of a footprint can be realized, and various effectiveness, such as cost reduction of a clean room, fall prevention of the natural frequency of the body of an aligner, and improvement in stage controllability ability, can be acquired in connection with this.

[0053] Moreover, it is effective in controlling the imprint error which originates in bending of the mask at the time of exposure according to the manufacture approach of a mask in the operation of the aligner concerning this invention and the exposure approach, and a list, and being able to realize highly precise exposure.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is drawing showing the outline configuration of the aligner of 1 operation gestalt.
[Drawing 2] It is drawing showing the example of an including-wafer stage (drive system) of equipment of drawing 1 concrete configuration.
[Drawing 3] It is drawing showing a modification and is drawing showing the aligner using dioptric system as projection optics.
[Drawing 4] It is the explanatory view showing the conventional example.
[Description of Notations]
10 [-- A reticle (mask), PL / -- Projection optics, W / -- A wafer (substrate), RST / -- A reticle stage (mask stage), WST / -- A wafer stage (substrate stage), F1 / -- Floor.] -- An aligner, 12 -- The body of an aligner, 14 -- An illumination system, R

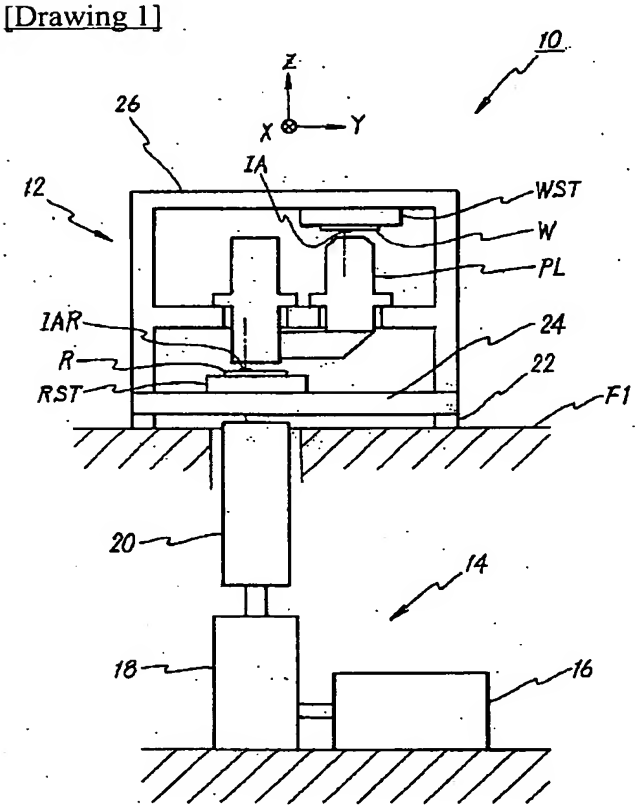
[Translation done.]

* NOTICES *

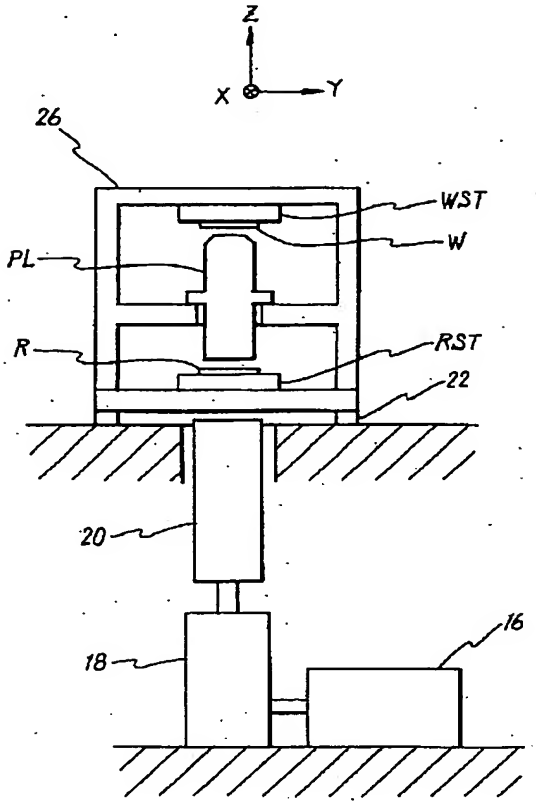
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

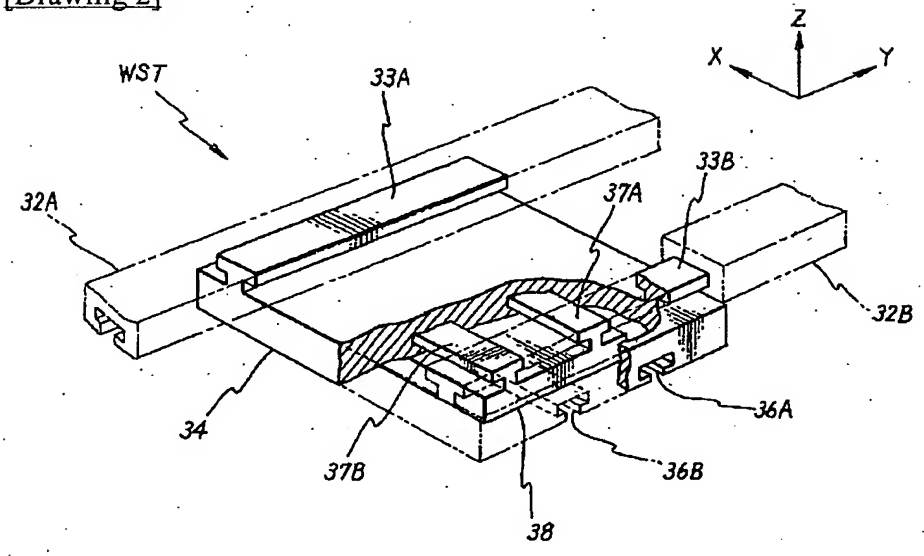
[Drawing 1]



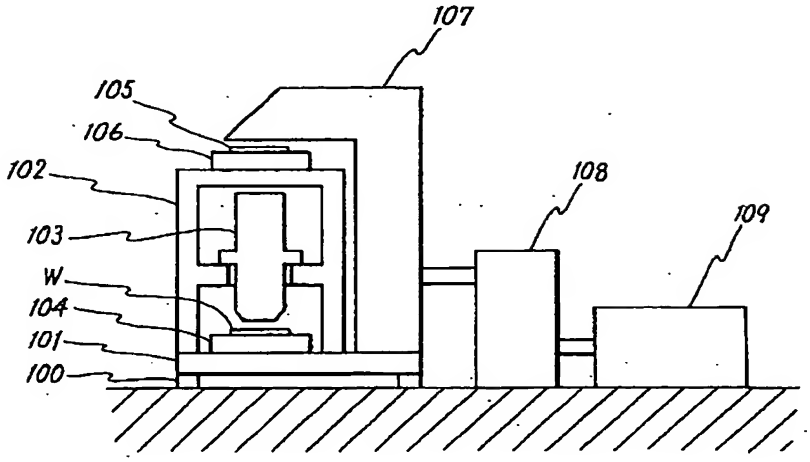
[Drawing 3]



[Drawing 2]



[Drawing 4]



[Translation done.]